quency of its mounds on given areas. The text and drawings are based partly on allied species inhabiting Colorado and California. Several pages of the text are devoted to its utility in making loam, and incidentally to showing the fallacy of Darwin's assumption that earthworms are found throughout the world, and are the chief agency in soil formation. Although in vast regions of the interior of North America there exists a stratum of humus, sometimes several feet in thickness, "earthworms are not native to any part of America south of the Great Slave Lake or west of the immediate Mississippi Valley," execept where they have been introduced.

This detailed, topical method of treatment is followed throughout the book, the illustrations varying with the character of the species treated, and include details of structure, poses of the animal, plans of runways, tracks, burrows, excrement (scatology), means of defense, etc.

The illustrations are usually the author's own, from sketches from life or from nature, the exceptions being usually skulls, which are mainly copied (with acknowledgments) from technical papers issued by the Biological Survey. The maps are the result of careful research, the ranges being compiled from the literature of the subject plus the author's personal information, the actual places of known capture being often indicated by dots within an admittedly hypothetical outline of the supposed range.

The author sticks closely to his text—the habits of the animals—to the exclusion of hunting stories and incidents of travel. Although the work is so voluminous the style is graphic and concise; the matter is pertinent and well stated, and there is no padding. There are some quotations from previous authors, some previously unpublished information from correspondents, credit for facts and data, published or unpublished, being bounteously given, but the great bulk of the matter is a record of the author's own observations and field explorations, carried on for a long series of years and over a wide range of country. As a contribution to the life histories of North American mammals it is without a rival, and beyond comparison the best work of its kind that has ever been written. Indeed, it is safe to say that nothing having the same scope and detail, either in text or illustrations, has ever before been attempted. These two ponderous volumes are a monument to the author's persistence and zeal through many long years of affectionate search for knowledge of the habits and intimate home life of our American mammals, to which the publishers have contributed a setting worthy of the subject.

J. A. ALLEN
AMERICAN MUSEUM OF NATURAL HISTORY,
NEW YORK CITY

The Green Bug and its Natural Enemies. By Professor S. J. HUNTER. Bulletin of the University of Kansas, Vol. IX., No. 2.

This, the most voluminous study of the parasitism of a plant louse thus far reported, is worthy of careful attention. The rapid spread of the recently imported *Toxoptera graminum* from Europe is well presented and the illustrations of the structure of this and the related native species are quite satisfactory. The most useful parts of the work are the elaborate breeding experiments both on the plant louse and on its most abundant parasite *Lysiphlebus tritici.* Indeed, the publication affords the best data we have at hand for the discussion of the question of the efficiency of parasites. Not a little of the work is devoted to a defense of the author's claims as to the results of an aggressive campaign in which he distributed nearly 9,000 boxes of these parasites.

The author is very thoroughly convinced that the parasites were effective, saying (p. 8): "That this parasite not only controlled, but in many cases practically exterminated, the green bug last season, no one questions," and (p. 24): "Professor Glenn on the basis of twenty-five fold increase estimates that one female parasite placed with 2,000 adult green bugs just beginning to reproduce would exterminate them in twenty-five days, and one female with 10,000 such adults would exterminate them in thirty days."

The data presented hardly support the contention of the author, however, as will be shown below. He considers the parasite to belong particularly with this species of aphis, saying (p. 163): "It appears that *Lysiphlebus* does not perpetuate itself and maintain a general distribution on these other hosts," though it was first described from Missouri in 1888, and this particular plant louse was not recorded as far west as Indiana until 1890.

He recognizes the importance of weather conditions and states (p. 9): "The green bug continues to be active and reproductive at a lower temperature than does this parasite," thus giving the plant louse a start in the spring, and his assistant, Professor Glenn, says in the appendix on the "influence of climate," referring to the plant louse (p. 180), "it can not endure the high temperatures which prevail in summer," and in reference to the parasite (p. 182): "During the hot months of July and August, they decrease in numbers because of a lack of hosts, since the green bugs can not endure temperatures much above 100° F."

Since the aphid appears thus to have a lower optimum temperature it is most favorable to the parasite to compare the shortest period of development of each, which is for the aphid 5 days, for the parasite 7 days. Earlier in the year the intervals given are 11.5 and 17.69 days, respectively. The large amount of data make the average rate of reproduction appear to be very reliable and for the purpose of calculation we may use the round numbers 2 per day for twenty-five days for the aphis and 8 per day for five days for the parasite. This is favorable to the latter, the actual figures being a total of 59 and 38 descendants, respectively, for the summer condition. Three fourths of the parasites are counted female, though the actual number is only two thirds.

The following table gives the results of a calculation made by me and based on the figures given above.

Day	Aphid		Parasite	
	Total	Reproducing Power of Adult	Egg-laying Power	Efficiency
1	1	100 %	8	8
2	3	68.5	8	5.92
3	5	47	8	3.76
4	7	32.2	8	2.57
5	9	22.8	8	1.82
6	11	15.7		
7	17	32.4		
8	27	37.5	48	3.5
9	41	37.2	96	5.5
10	59	32 5	144	5.15
11	81	26.9	192	4.7
12	115	28.5	240	4.2
13	169	31.1	192	2.05
14	251	31.7	144	1.11
15	369	31.8	384	2.1
16	531	31.1	908	3.8
17	761		1,727	4.7
18	1,099		2,876	5.36
19	1,601		4,336	5.4
20	2,339		5,200	4.42
21	3,401		5,488	3.24
22	4,933		6,952	3.19
23	7,131		11,258	3.22
24	10,333	31.4	20,162	3.92
25	15,011		36,266	4.9
26	21,813		61,418	5.69
27	30,657		90,314	5.76
28	44,907		117,794	5.18
29	65,561		149,162	4.53
30	95,571		199,454	4.17

In explanation of the table it may be said that only the large aphids are parasitized and nearly 85 per cent. are young insects when they are increasing at full capacity. Since one aphid produces 65,000 in 29 days and 95,000 in 30 days, the difference between these figures represents the descendants of the first two young insects and the ratio between these figures (68.5 per cent.) gives the reproductive power of the adult insect, which alone is liable to parasitization. The last column is obtained by dividing the figures showing egg-laying power by the number of adults (found by counting back five lines in the first column) and multiplying the quotient by the reproductive power of the adults. Thus the killing of 8 insects the second day affects the total of progeny the same as the killing of 5.92 on the first day, before the young had been produced. Adding the last column gives us the total result of the work of the parasite for any date within the month. The total for the month is 117.82. Had this number been killed the first day, the result on the total progeny would have been the same as that secured by killing over 700,000 plant lice and attaching the mummies of those dead plant lice to wheat stalks.

The total effect of the parasite has scarcely more than 1 per cent. of the efficiency claimed for it in the publication under consideration, even though this is figured on a 40-fold increase instead of 25-fold. In every particular the assumptions upon which the above table is based are more favorable for the parasite than the experimental data presented by Mr. Hunter justify. And, moreover, the efficiency of the parasite does not increase by any such proportion as is generally assumed, the weekly averages only varying from each other by a small fraction, showing that years would have to elapse before the parasite would reach the efficiency supposed to be attained in twenty-five days or a month.

Of course, other factors enter into the problem, but the point that this calculation demonstrates is that these other factors are so much more important that, as compared with them, the work of the parasite is a negligible factor.

As corroborative evidence the author quotes Professor Marchal's account of the efficiency of the Australian ladybird against the cottony cushion scale. It may be instructive to state that during the last eighteen years this supposedly suppressed scale insect has figured as largely in the correspondence of the entomological department of the University of California as any scale existing in the state, and that on the university grounds and in the surrounding region it is now and has been all these years the most injurious scale insect present with the possible exception of the black scale.

Nearly all previous discussions of the efficiency of parasites or predaceous insects have been records of impressions instead of the presentation of experimental data. This author has accumulated a splendid lot of data, but has not used it. Like the others of us, he has been so impressed with the evidence he saw in the form of innumerable plant-louse mummies that he failed to grasp the importance of other conditions, probably largely meteorological, which might have caused the disappearance of the lice equally as soon had there been no parasites present. Aside from this one question of interpretation the work will be of great value to subsequent students of parasitism.

C. W. WOODWORTH
UNIVERSITY OF CALIFORNIA

Geology of the City of New York. By L. P. GRATACAP. Third edition. 8vo, pp. x + 232, 65 figs., 4 maps. New York, Henry Holt and Co. 1909. $2.50.

Gratacap's "Geology of the City of New York" was originally issued in 1901 as a pamphlet of 82 pages, specially designed for teachers of science, for pupils in the schools of the city and for the general reader to whom the metropolitan district furnished an attractive field of observation and study. The American Museum of Natural History conducts most commendable series of lectures for the teachers of the city and the manual found in them a constituency greatly needing just such a work. With the second edition the text was expanded to 119 pages, and now with the third the size of page is reduced from royal octavo to the more convenient octavo size and is expanded to embrace the latest results of study in the district. Practically a new book has been prepared.

The work opens with a general introduction intended to place the reader in command of the facts of stratigraphical classification, and, since the area is a metamorphic one, with the general principles and processes of this branch of geology. Manhattan Island is then described in detail; its topography, its rocks, its waterways, its minerals, etc. The boroughs of Brooklyn and Queens are next treated in a similar but much less detailed manner. Being covered with glacial drift throughout almost all of their area they furnish fewer rock exposures. The borough of the Bronx, although nearly as large as Manhattan and of similar formations, receives but a brief mention of four pages, and the borough of Richmond or Staten Island about four times as much. The evidences of glaciation in and about Greater New York are then taken up in the concluding pages.

The work contains a great deal of valuable record that will prove serviceable to engineers and contractors as well as to teachers and those with a popular interest in science. There